FEBRUARY 2003 MIDS FLOW STUDY

(Kate Le 3/25/2003)

Background/Objective

In fall 2002, the Morrow Island Distribution System (MIDS) intake gate was replaced with a new combination gate (flap and screw combination). The pipes are 48-inch high density polyethylene and thus are significantly smoother than the replaced corrugated asphalt coating pipes. The MIDS gate coefficient in DSM2 required revision to reflect the new material. A flow study was designed in collaboration with Central District (CD) staff for calibration of the DSM2 flow coefficient at MIDS. The flow study results would then be used to verify what flow coefficient would best represent real world conditions in a 1-D model. Also, the study would provide insight on the tidal volume exchange between Goodyear Slough and the MIDS intake.

Location and Setup of Flow Study

MIDS is located about ½ mile south of the Goodyear monitoring station (S35). The setup of the flow study is shown in Figure 1. Two half days of flow studies were conducted. The first flow study was on February 19 with the tide phase of low-high to high-high, and the second study was on February 26(a week after) with a tide phase of high-high to low-low. Three flow monitoring apparatus were used for the study: 2 Price current meters and 1 acoustic doppler current profiler. The culvert gates were set fully open (i.e. 48") on the MIDS side and opened 18" on the Goodyear slough side.

Positive flow direction is taken to be north in Goodyear Slough and east (out towards the Bay) in the MIDS.

Data and Analysis

Goodyear Slough flow (collected by CD staff) data and stage data at the intake (from DWR, Delta Field Division) were gathered and processed for comparison with model results for the same flow period. An important factor to note is that in the model, the intake is modeled as a one-way gate, whereas we observed flow going both ways in the MIDS culverts.

Three model runs were conducted, each with a different flow coefficient. Run 1 used a flow coefficient of 0.5(base case), run 2 used 0.6, and run 3 used 0.2. Comparison of model results vs. field data are shown in Figure 2 through 5.

Figure 2 compares model and field flow on February 19, 2003, for the three flow coefficients. A flow coefficient of 0.5 (blue color line) was used in the model prior to this validation. Results indicate that a flow coefficient of 0.2 (cyan color line) matches best with field flow data (red color line).

Figure 3 compares model and field flow on February 19, 2003, in the MIDS and Goodyear Slough with a flow coefficient of 0.2. The blue (DSM2) and cyan (field) lines represent the MIDS. The upstream end of Goodyear Slough comparison is the red line (DSM2) versus the pink line (field). The downstream end of Goodyear Slough comparison is the green line (DSM2) versus the gray line (field). Model flow results at the upstream and downstream underestimate tidal flow when compared to field data, however, the pattern and phasing matches quite well.

Figure 4 is similar to that of Figure 3, however, it represents February 26, 2003 results. Again, estimated flows at both upstream (red vs. pink lines) and downstream (green versus gray lines) under predict compared to field flow data. The blue (DSM2) and cyan (field) lines represent the inside MIDS. The blue line is flat and cyan line is not because the MIDS is modeled as a one-way flow, but on that day the gate was operated to allow two-way flow.

Figure 5 is a plot of model stage versus field stage inside and outside the MIDS for February 19 and 26, 2003. The outside stages of model results and field data match well on both days. However, the inside stages of model results and field data differ. The stage for model results is ahead of field data by about 15 minutes. Despite this difference, overall the model does very well trying to represent a 3-dimensional system.

Conclusion/Recommendations

Based on model results for various flow coefficients, the best fit to represent field data is a flow coefficient of 0.2. Thus, we want to recommend changing the flow coefficient used in DSM2 to represent the Morrow Island Distribution system from 0.5 to 0.2.

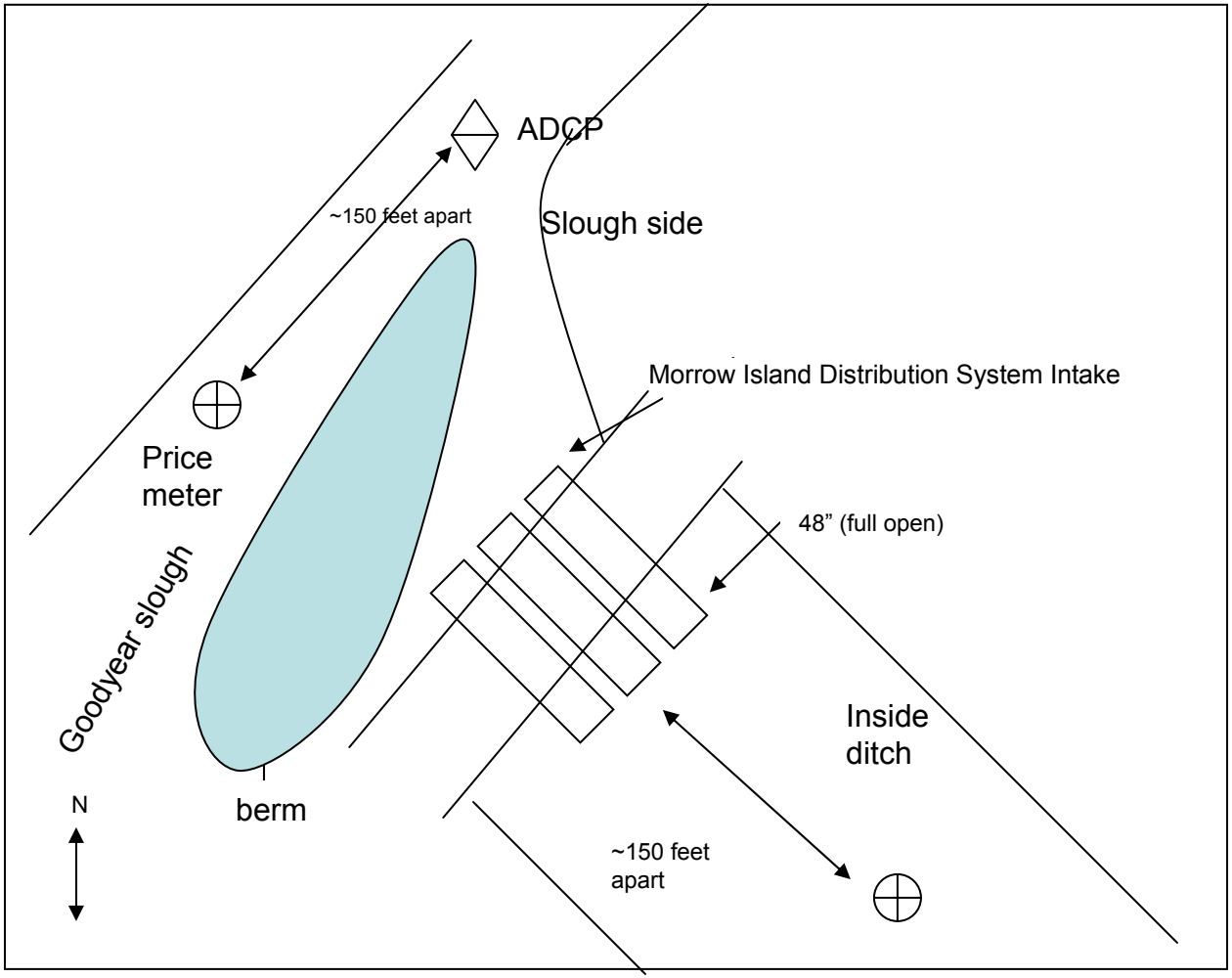

Figure 1: Diagram of flow study configuration.

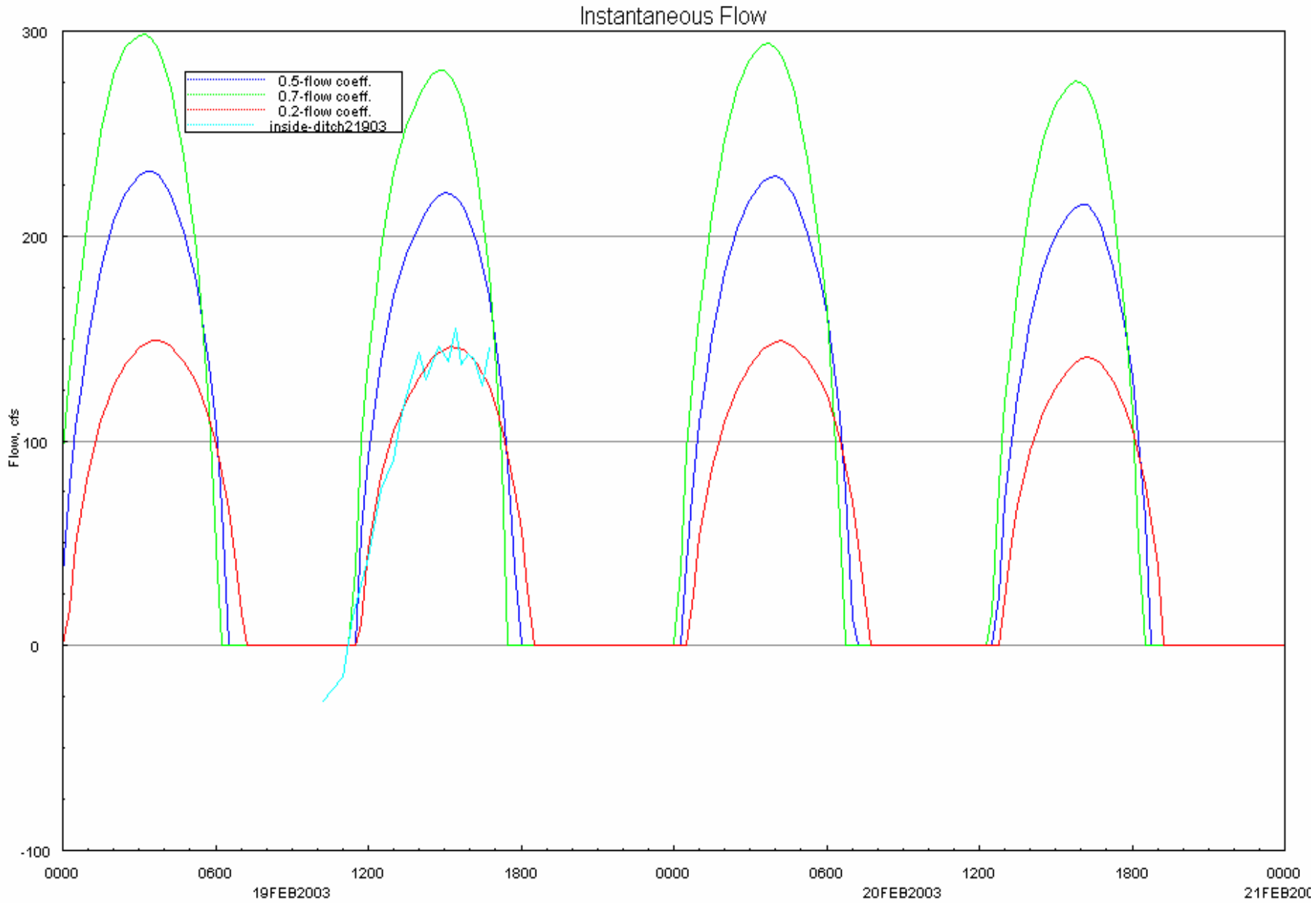

Figure 2: Flow comparison of DSM2 vs field under various flow coefficients.

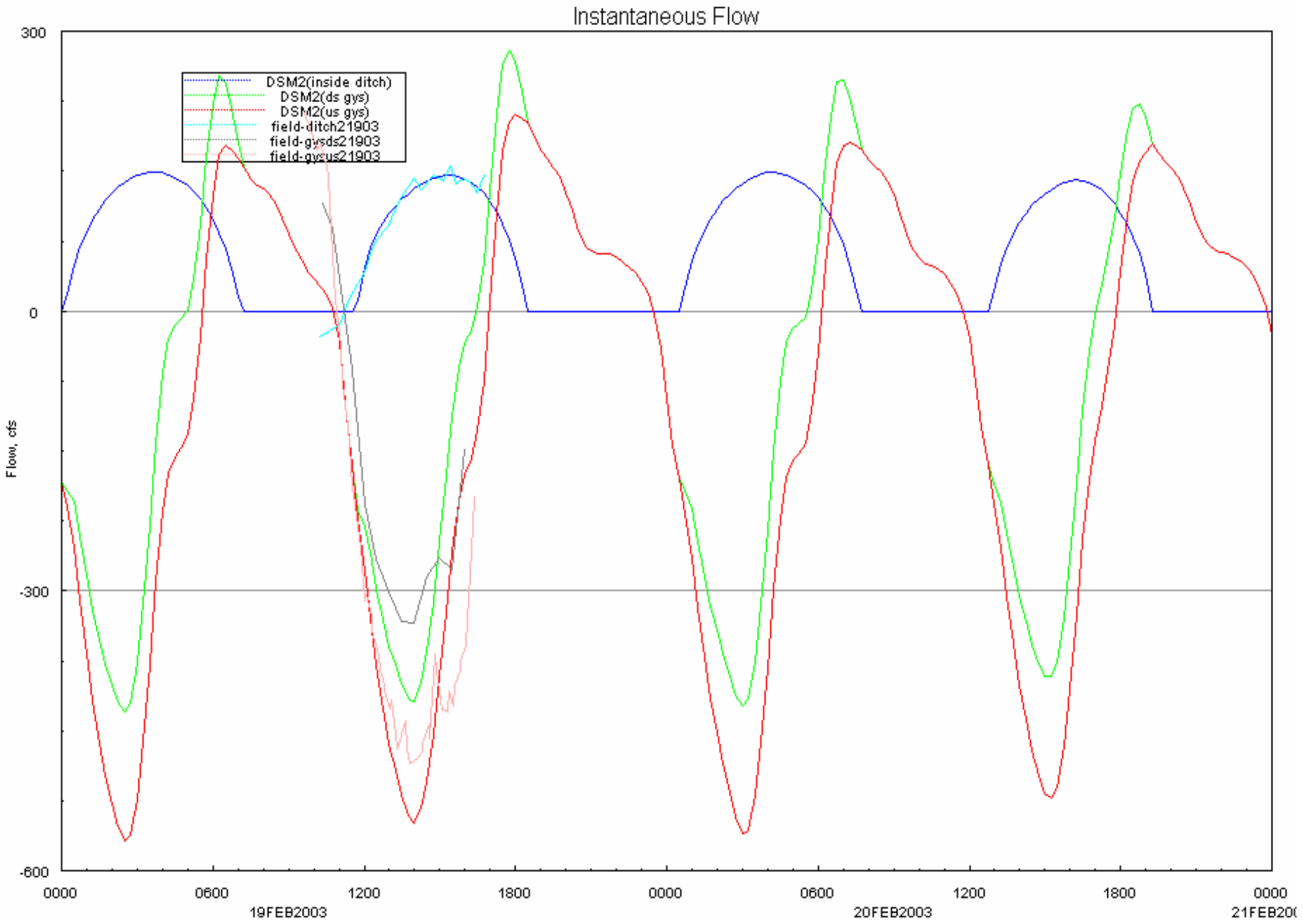

Figure 3: Flow comparison of DSM2 vs field on February 19, 2003.

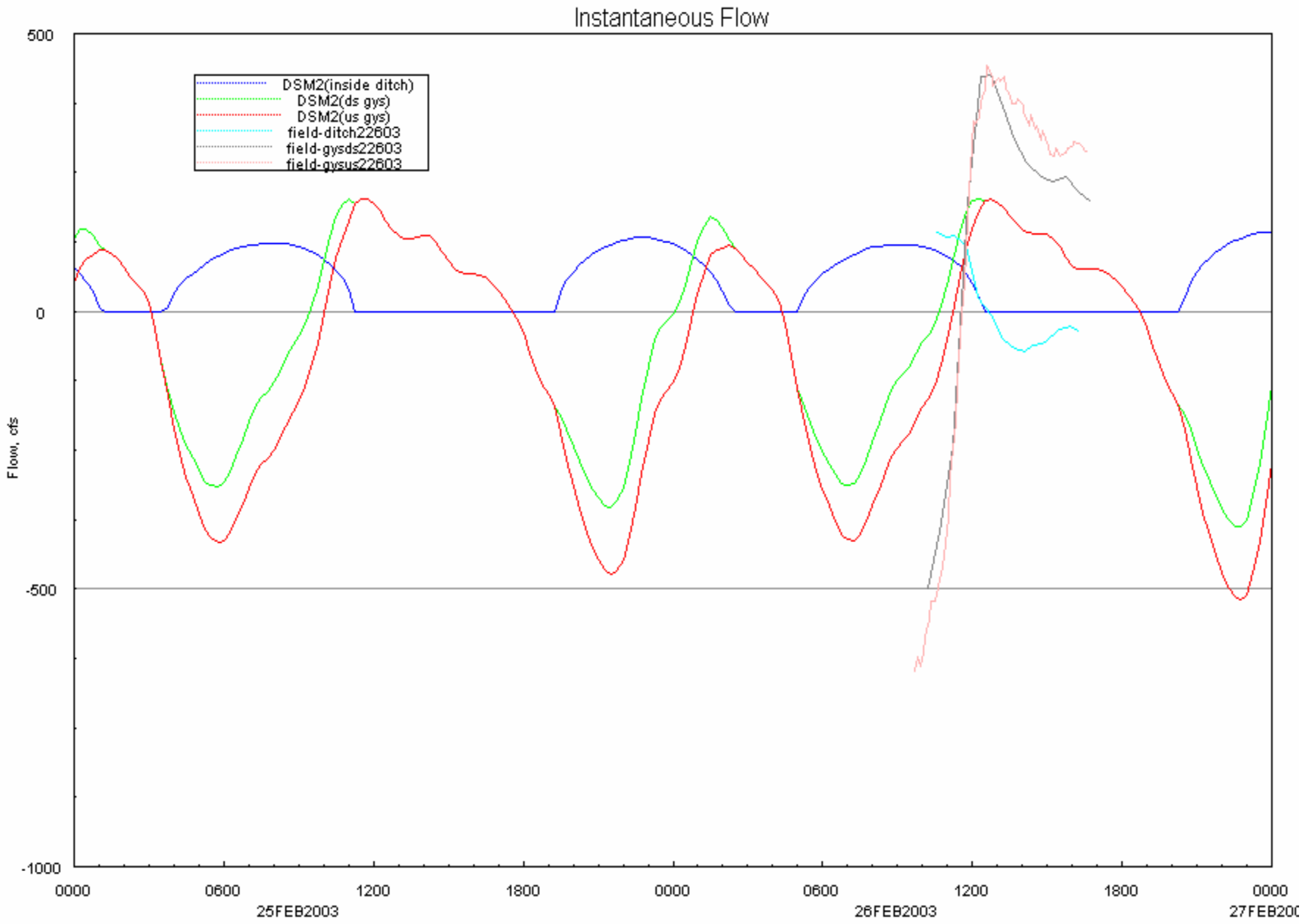

Figure 4: Flow comparison of DSM2 vs field on February 26, 2003.

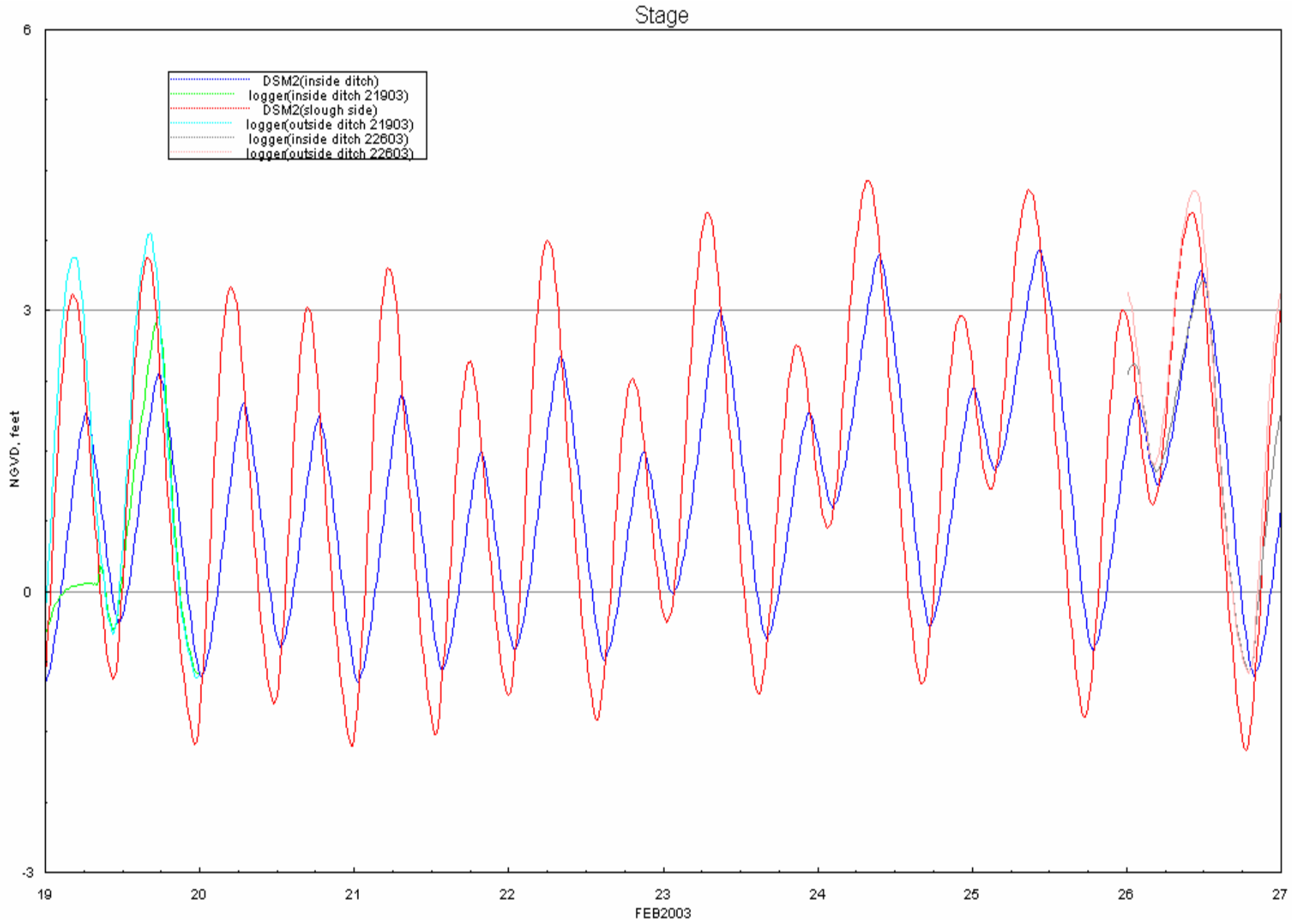

Figure 5: Stage comparison of DSM2 vs field on February 19 and 26, 2003.